subareas of said exposed area to other subareas in the vicinity of said selected subareas whereby said comparison is performed by computing for a selected test subarea of said exposed area the values ($H_T$, $L_T$) wherein $H_T$ is a function of the attenuation of said x-rays at the higher energy band at said test subarea and $L_T$ is a function of the attenuation of said x-rays at the lower energy band at said test subarea and computing for a subarea nearby said test subarea the values ($H_B$, $L_B$) wherein $H_B$ is a function of the attenuation of said x-rays at the higher energy band at said nearby subarea and $L_B$ is a function of the attenuation of said x-rays at the lower energy band at said nearby subarea, and employing said values ($H_T$, $L_T$) and ($H_B$,$L_B$) in determining the presence of said specific material.

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2. (Amended) A device for detecting [a bomb] an object of interest that may be present in a container of objects comprising [means]

an x-ray source adapted to expose an area of [the] said container to x-ray radiation of two substantially different energy bands, [energies]

a detector, responsive to said source, adapted to detect radiation passing through said container and to produce dual energy areal image information of [the] said container and its contents based on differences in absorption of said x-rays, and [means]

a computer adapted to [computer-] process such dual energy information to detect said [bomb] object of interest on the basis of comparisons of x-ray attenuation values ($H_T$, $L_T$) and

$(H_B, L_B)$ representing the substantially logarithmic dependence of x-rays absorption when passing through objects, wherein $H_T$ and $H_B$ represent the attenuation of said x-rays at the higher energy band at said test subarea and said nearby subarea, respectively, and $L_T$ and $L_B$ represent the attenuation of said x-rays at the lower energy band at said test subarea and said nearby subarea, respectively,

said comparisons employing the $(H_T, L_T)$ and $(H_B, L_B)$ values of selected test subareas of said exposed area [to] and other nearby subareas in the vicinity of said selected test subareas, respectively, to determine the presence of said object of interest.

Please cancel claim 12.

12 ~~13~~. (Amended) [The device of claim 12] A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, and indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble wherein said comparison means

includes a lookup table reflecting attenuation at high and low energy bands over a range of thicknesses of a selected specific material and a range of thicknesses of a representative overlay material, with attenuation of a constant thickness of said overlay material and varying thicknesses of said specific material represented by a parameter P.

B2

13. ~~15~~. (Amended) [The device of claim 12] A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, and indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble wherein said comparison means include means to combine, according to a predetermined formula, values representing the attenuation of said x-rays for subareas in said neighborhood to provide an attenuation measure and means to compare said measure to a reference related to said specific material.

B3

14. ~~16~~. (Amended) [The device of claim 12] A device for inspecting an ensemble of physical objects comprising means to

expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, and indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble wherein said values generated representing the attenuation of said x-rays at said energy bands are logarithms of x-ray attenuation at each of said energy bands at each subarea.

B3

24 ~~30~~ ~~17~~. (Amended) [The device of claim 12] A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, and indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble wherein said comparison means comprises means for computing for a selected test subarea of said



Claims 15-17

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area the values ($H_T$,$L_T$) wherein $H_T$ is the logarithm of the attenuation of said x-rays at said higher energy band at said test subarea and $L_T$ is the logarithm of the attenuation of said x-rays at said lower energy band at said test subarea, means for computing for a subarea nearby said test subarea the values ($H_B$,$L_B$) wherein $H_B$ is the logarithm of the attenuation of said x-rays at said higher energy band at said nearby subarea and $L_B$ is the logarithm of the attenuation of said x-rays at said lower energy band at said nearby subarea, said comparison means constructed to employ said values ($H_T$,$L_T$) and ($H_B$,$L_B$) in determining the presence of said specific material.

B3

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33 ~~25.~~ (Amended) [The device of claim 12 further comprising] A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble, and means for exposing selected numbers of samples of various known materials each of a range of different thicknesses to said x-rays of said different

B4

energy bands to measure the attenuation characteristic of the exposed samples to provide a reference for said comparison means.

~~27~~ 35. (Amended) The device as in any one of claims 3[-] through ~~11~~ 11 and ~~13~~ 12 through ~~26~~ 33 further comprising means for assigning to subareas over said exposed area of the object relative probabilities for the presence of said specific material based upon said comparisons, said indicating means being responsive to said relative probability assignments for indicating presence of said specific material in said object.

Subc2

34. (Amended) The device of claim 1, 2, 3, 15 or [12] 16 wherein said means to expose said area further comprises an x-ray source, means for generating from said source x-rays of at least two substantially different energy bands, means for collimating a fan beam of said x-rays, and means for conveying said object to intercept said fan beam of said x-rays.

~~35~~ 16. (Amended) The device of claim ~~15~~ 13 or ~~16~~ 14 [12,] wherein said indicating means is a visual display of an x-ray image, and said indication being of the form of distinguished subareas at which the specific material is probably present.

~~36~~ 42. (Amended) The device of claim 1, 2, 3, ~~15~~ 13, ~~16~~ 14 [12] or ~~28~~ 36, wherein said specific material is a threatening substance.

Claim 43



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~~38~~ 44. (Amended) The device of claim 1, 2, 3, ~~15, 16~~ 13, 14 [12] or ~~28~~ 36, wherein said specific material is an illicit drug substance.

b1

~~39~~ 17. (Amended) The device of claim [1,] 3, ~~15~~ 13 or ~~16~~ 14 [12,] wherein said ensemble comprises components of a stream of matter.

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~~43~~ 21. (Amended) The device of claim [1,] 3, ~~15~~ 13 or ~~16~~ 14 [12,] wherein said ensemble comprises foodstuffs.

b4 K

~~46~~ 45. (Amended) [The device of claim 1 or 2 further comprising] A device for detecting a specific material that may be present in an ensemble of objects comprising means to expose an area of the ensemble to x-ray energies to produce dual energy image information of the ensemble, means to computer-process such dual energy information to detect said specific material on the basis of comparisons of selected subareas of said exposed area to other subareas in the vicinity of said selected subareas, means for locating edges in the exposed area where one material overlaps another, means for choosing subareas in close proximity to said edges to be said selected subareas, and means for assigning to said selected subareas a relative probability for the presence of said specific materials at said subareas based upon said comparisons with other subareas in the vicinity, and indicating means responsive to said relative probability assignment.

B9

46 ~~47~~. (Amended) [The device of claim 12 further comprising] A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the presence of a specific material in the neighborhood, indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble, means for locating edges in the exposed area where one material overlaps another, means for choosing subareas in close proximity to said edges to be said selected subareas, and means for assigning to said selected subareas a relative probability for the presence of said specific materials at said subareas based upon comparisons with other subareas in the neighborhood, said indicating means being responsive to said relative probability assignment.

B4

47 ~~48~~. (Amended) The device of claim [1, 2, 12,] 45 ~~46~~ or 46 ~~47~~ further comprising means for dilating indications of subareas over regions whose edges have been determined to indicate the presence of said specific material, wherein said dilation makes said regions more prominently noticeable to an operator of said device, and wherein said dilation enhances indication of presence of said specific material.

Claim 48

Sub C3

49. (Amended) A method of detecting a specific material that may be present in an ensemble of objects comprising the steps of

exposing an area of the ensemble to x-ray radiation of two substantially different energy bands, [energies]

detecting radiation passing through the ensemble and producing [to produce] dual energy areal image information of [the] said exposed ensemble, and [computer-]

B9

processing such dual energy information based on differences in attenuation between subareas of said exposed area to detect presence of said specific material by comparing [on the basis of comparisons of] selected subareas of said exposed area to other subareas in the vicinity of said selected subareas whereby said comparison is performed by computing for a selected test subarea of said exposed area the values $(H_T, L_T)$ wherein $H_T$ is a function of the attenuation of said x-rays at the higher energy band at said test subarea and $L_T$ is a function of the attenuation of said x-rays at the lower energy band at said test subarea and computing for a subarea nearby said test subarea the values $(H_B, L_B)$ wherein $H_B$ is a function of the attenuation of said x-rays at the higher energy band at said nearby subarea and $L_B$ is a function of the attenuation of said x-rays at the lower energy band at said nearby subarea, and employing said values $(H_T, L_T)$ and $(H_B, L_B)$ in determining the presence of said specific material.

49 ~~50~~. (Amended) A method of detecting [a bomb] an object of interest that may be present in a container of objects comprising the steps of

P1 exposing an area of the container to x-ray radiation of two substantially different energy bands, [energies]

P1 detecting radiation passing through the ensemble and producing [to produce] dual energy areal image information of [the] said exposed ensemble, and [computer-]

B9

P1 processing such dual energy information to detect said [bomb] object of interest on the basis of comparisons of x-ray attenuation values $(H_T, L_T)$ and $(H_B, L_B)$ representing the substantially logarithmic dependence of absorption of x-rays passing through objects, wherein $H_T$ and $H_B$ represent the attenuation of said x-rays at the higher energy band at said test subarea and said nearby subarea, respectively, and $L_T$ and $L_B$ represent the attenuation of said x-rays at the lower energy band at said test subarea and said nearby subarea, respectively, said comparisons employing the $(H_T, L_T)$ and $(H_B, L_B)$ values of selected test subareas of said exposed area [to] and other nearby subareas in the vicinity of said selected test subareas, respectively, to determine the presence of said object of interest.

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NP

54 ~~55~~. (Amended) The method as in any one of claims 48 ~~49~~[-] through 53 ~~54~~ further comprising employing computed tomographic information to detect said specific material that may be present in subareas indicated by said computer-processed dual energy

B18

NK



113

B10 N P

information as being probable subareas for the presence of said specific materials.

N K

Please cancel claim ~~56.~~ Please add the following new claims:

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~~63~~. A device for detecting a specific material that may be present in an ensemble of objects comprising means to expose an area of the ensemble to x-ray energies to produce dual energy image information of the ensemble, means to computer process such dual energy information to detect said specific material on the basis of comparisons of selected subareas of said exposed area to other subareas in the vicinity of said selected subareas, and means for dilating indications of subareas over regions whose edges have been determined to indicate the presence of said specific material, wherein said dilation makes said regions more prominently noticeable to an operator of said device, and wherein said dilation enhances indication of presence of said specific material.

B11

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~~64~~. A device for inspecting an ensemble of physical objects comprising means to expose an area of said ensemble to x-rays of at least two substantially different energy bands, detection means responsive to said x-rays passing through said ensemble to generate for subareas over said area respective sets of values representing the attenuation of said x-rays at each of said energy bands, comparison means operative on differences in attenuation between subareas in a neighborhood to determine the



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presence of a specific material in the neighborhood, indicating means responsive to said comparisons for indicating presence of said specific material in said ensemble, and means for dilating indications of subareas over regions whose edges have been determined to indicate the presence of said specific material, wherein said dilation makes said regions more prominently noticeable to an operator of said device, and wherein said dilation enhances indication of presence of said specific material.

B11 63 ~~65~~. A device for detecting a specific material of interest in a package or suitcase comprising:

P1 x-ray source adapted to expose a package or suitcase to x-ray radiation of at least two substantially different energy bands,

P1 detector, responsive to said source, adapted to acquire x-ray transmission data through many spatially adjacent points of said package or suitcase at said energy bands,

P1 computer adapted to treat said x-ray data spatially as numerous "object" regions and neighboring background regions, where each "object" region is taken as having substantially the same x-ray attenuating properties as a neighboring background region except for the additional presence of unknown material, to process said x-ray data in numerous "object" regions and respective neighboring background regions to characterize at least one x-ray property of the assumed unknown material of the "object" regions with the contribution of background removed, and